

Gopalan College of Engineering & Management
Dept Of ME - Regulation 2018

Year:II

SEM:III

Course code:18MAT31		Course Name:TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.	
CO2	Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.	
CO3	Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.	
CO4	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.	
CO5	Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.	

Course code:18ME32		Course: MECHANICS OF MATERIALS
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Understand simple, compound, thermal stresses and strains their relations and strain energy	
CO2	Analyse structural members for stresses, strains and deformations.	
CO3	Analyse the structural members subjected to bending and shear loads.	
CO4	Analyse shafts subjected to twisting loads.	
CO5	Analyse the short columns for stability.	

Course code:18ME33		Course:BASIC THERMODYNAMICS
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Explain fundamentals of thermodynamics and evaluate energy interactions across the boundary of thermodynamic systems.	
CO2	Evaluate the feasibility of cyclic and non-cyclic processes using 2nd law of thermodynamics.	
CO3	Apply the knowledge of entropy, reversibility and irreversibility to solve numerical problems and apply 1st law of thermodynamics to closed and open systems and determine quantity of energy transfers and change in properties.	
CO4	Interpret the behavior of pure substances and its application in practical problems.	
CO4	Recognize differences between ideal and real gases and evaluate thermodynamic properties of ideal and real gas mixtures using various relations	

Course code:18ME34		Course:MATERIAL SCIENCE
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Understand the mechanical properties of metals and their alloys.	
CO2	Analyze the various modes of failure and understand the microstructures of ferrous and non- ferrous materials	
CO3	Describe the processes of heat treatment of various alloys.	
CO4	Acquire the Knowledge of composite materials and their production process as well as applications.	
CO5	Understand the properties and potentialities of various materials available and material selection procedures.	

Course code:18ME35A		Course:METAL CUTTING AND FORMING
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Explain the construction & specification of various machine tools.	
CO2	Discuss different cutting tool materials, tool nomenclature & surface finish.	
CO3	Apply mechanics of machining process to evaluate machining time.	
CO4	Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.	
CO5	Understand the concepts of different metal forming processes.	
CO6	Apply the concepts of design of sheet metal dies to design different dies for simple sheet metal components.	

Course code:18ME36A		Course:COMPUTER AIDED MACHINE DRAWING
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Identify the national and international standards pertaining to machine drawing.	
CO2	Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings	
CO3	Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.	
CO4	Interpret the Machining and surface finish symbols on the component drawings.	
CO5	Preparation of the part or assembly drawings as per the conventions.	

Course code:18MEL37A		Course:MATERIAL TESTING LAB
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Acquire experimentation skills in the field of material testing.	
CO2	Develop theoretical understanding of the mechanical properties of materials by performing experiments.	
CO3	Apply the knowledge to analyse a material failure and determine the failure inducing agents.	
CO4	Apply the knowledge of testing methods in related areas.	
CO5	Understand how to improve structure/behaviour of materials for various industrial applications.	

Course code:18MEL38A		Course:WORKSHOP AND MACHINE SHOP PRACTICE
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	To read working drawings, understand operational symbols and execute machining operations.	
CO2	Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc.	
CO3	Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used.	
CO4	Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations.	
CO5	Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.	
CO6	Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing and Gear cutting and estimate cutting time.	

Course code:18CPC39/49		Course:CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Have constitutional knowledge and legal literacy.	
CO2	Understand Engineering and Professional ethics and responsibilities of Engineers.	
CO3	Understand the the cybercrimes and cyber laws for cyber safety measures.	

Course code:18MATDIP31		Course:ADDITIONAL MATHEMATICS – I
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.	
CO2	Use derivatives and partial derivatives to calculate rate of change of multivariate functions.	
CO3	Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.	
CO4	Learn techniques of integration including the evaluation of double and triple integrals.	
CO5	Identify and solve first order ordinary differential equations.	

Year:II		SEM:IV
Course code:18MAT41		Course:COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.	
CO2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.	
CO3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	
CO4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.	
CO5	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.	

Course code:18ME42		Course:APPLIED THERMODYNAMICS
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Apply thermodynamic concepts to analyze the performance of gas power cycles.	
CO2	Apply thermodynamic concepts to analyze the performance of vapour power cycles.	
CO3	Understand combustion of fuels and performance of I C engines.	
CO4	Understand the principles and applications of refrigeration systems.	
CO5	Apply Thermodynamic concepts to determine performance parameters of refrigeration and air- conditioning systems.	
CO6	Understand the working principle of Air compressors and Steam nozzles, applications, relevance of air and identify methods for performance improvement.	

Course code:18ME43		Course:FLUID MECHANICS
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Identify and calculate the key fluid properties used in the analysis of fluid behavior.	
CO2	Explain the principles of pressure, buoyancy and floatation	
CO3	Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering.	
CO4	Describe the principles of fluid kinematics and dynamics.	
CO5	Explain the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.	
CO6	Illustrate and explain the basic concept of compressible flow and CFD	

Course code:18ME44		Course:KINEMATICS OF MACHINES
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Knowledge of mechanisms and their motion.	
CO2	Understand the inversions of four bar mechanisms.	
CO3	Analyse the velocity, acceleration of links and joints of mechanisms.	
CO4	Analysis of cam follower motion for the motion specifications.	

CO5	Understand the working of the spur gears.
CO6	Analyse the gear trains speed ratio and torque.

Course code:18ME45B		Course:METAL CASTING AND WELDING
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Describe the casting process and prepare different types of cast products.	
CO2	Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, Sand Slinger moulding machines.	
CO3	Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.	
CO4	Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mould castings.	
CO5	Understand the Solidification process and Casting of Non-Ferrous Metals.	
CO6	Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing.	
CO7	Describe methods for the quality assurance of components made of casting and joining process.	

Course code:18ME46B		Course:MECHANICAL MEASUREMENTS AND METROLOGY
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters.	
CO2	Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design	
CO3	Understand the working principle of different types of comparators.	
CO4	Describe measurement of major & minor diameter, pitch, angle and effective diameter of screw threads.	
CO5	Explain measurement systems, transducers, intermediate modifying devices and terminating devices..	
CO6	Describe functioning of force, torque, pressure, strain and temperature measuring devices.	

Course code:18MEL47B		Course:MECHANICAL MEASUREMENTS AND METROLOGY LAB
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer.	
CO2	Apply concepts of Measurement of angle using Sine Centre/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.	
CO3	Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.	
CO4	Analyse tool forces using Lathe/Drill tool dynamometer.	
CO5	Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometer	
CO6	Understand the concepts of measurement of surface roughness.	

Course code:18MEL48B		Course:FOUNDRY, FORGING AND WELDING LAB
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.	
CO2	Demonstrate skills in determining permeability, clay content and Grain Fineness Number of base sands.	
CO3	Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.	

Year:III		SEM:V
Course code:18ME51		Course:MANAGEMENT AND ECONOMICS
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand needs, functions, roles, scope and evolution of Management	
CO2	Understand importance, purpose of Planning and hierarchy of planning and also analyse its types.	
CO3	Discuss Decision making, Organizing, Staffing, Directing and Controlling.	
CO4	Select the best economic model from various available alternatives.	
CO5	Understand various interest rate methods and implement the suitable one.	
CO6	Estimate various depreciation values of commodities.	
CO7	Prepare the project reports effectively.	

Course code:18ME52		Course: DESIGN OF MACHINE ELEMENTS- I
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Apply the concepts of selection of materials for given mechanical components.	
CO2	List the functions and uses of machine elements used in mechanical systems.	
CO3	Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's catalogue.	
CO4	Analyse the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure.	
CO5	Demonstrate the application of engineering design tools to the design of machine components like shafts, couplings, power screws, fasteners, welded and riveted joints.	
CO6	Understand the art of working in a team	

Course code:18ME53		Course:DYNAMICS OF MACHINES
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Analyse the mechanisms for static and dynamic equilibrium.	
CO2	Carry out the balancing of rotating and reciprocating masses	
CO3	Analyse different types of governors used in real life situation.	
CO4	Analyse the gyroscopic effects on disks, airplanes, stability of ships, two and four wheelers	
CO5	Understand the free and forced vibration phenomenon.	
CO6	Determine the natural frequency, force and motion transmitted in vibrating systems.	

Course code:18ME54		Course:TURBO MACHINES
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Model studies and thermodynamics analysis of turbomachines.	
CO2	Analyse the energy transfer in Turbo machine with degree of reaction and utilisation factor	
CO3	Classify, analyse and understand various type of steam turbine.	
CO4	Classify, analyse and understand various type of hydraulic turbine.	
CO5	Understand the concept of radial power absorbing machine and the problems involved during its operation.	

Course code:18ME55		Course:FLUID POWER ENGINEERING
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	

CO1	Identify and analyse the functional requirements of a fluid power transmission system for a given application.
CO2	Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
CO3	Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro- pneumatics for a given application.
CO4	Select and size the different components of the circuit.
CO5	Develop a comprehensive circuit diagram by integrating the components selected for the given application.

Course code:18ME56		Course: OPERATIONS MANAGEMENT
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Explain the concept and scope of operations management in a business context	
CO2	Recognize the role of Operations management among various business functions and its role in the organizations' strategic planning and gaining competitive advantage.	
CO3	Analyze the appropriateness and applicability of a range of operations management systems/models in decision making.	
CO4	Assess a range of strategies for improving the efficiency and effectiveness of organizational operations.	
CO5	Evaluate a selection of frameworks used in the design and delivery of operations	

Course code:18MEL57		Course:FLUID MECHANICS AND MACHINES LAB
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Perform experiments to determine the coefficient of discharge of flow measuring devices.	
CO2	Conduct experiments on hydraulic turbines and pumps to draw characteristics.	
CO3	Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.	
CO4	Determine the energy flow pattern through the hydraulic turbines and pumps.	
CO5	Exhibit his competency towards preventive maintenance of hydraulic machines.	

Course code:18MEL58		Course:ENERGY CONVERSION LABORATORY
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Perform experiments to determine the properties of fuels and oils.	
CO2	Conduct experiments on engines and draw characteristics.	
CO3	Test basic performance parameters of I.C. Engine and implement the knowledge in industry.	
CO4	Identify exhaust emission, factors affecting them and exhibit his competency towards preventive maintenance of IC engines.	

Course code:18CIV59		Course:ENVIRONMENTAL STUDIES
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale	
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.	
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.	
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.	

Year:III		SEM:VI
Course code:18ME61		Course:FINITE ELEMENT METHODS
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Identify the application and characteristics of FEA elements such as bars, beams, plane and iso- parametric elements.	
CO2	Develop element characteristic equation and generation of global equation.	
CO3	Formulate and solve Axi-symmetric and heat transfer problems.	
CO4	Apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems	

Course code:18ME62		Course: DESIGN OF MACHINE ELEMENTS II
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Apply design principles for the design of mechanical systems involving springs, belts, pulleys, and wire ropes.	
CO2	Design different types of gears and simple gear boxes for relevant applications.	
CO3	Understand the design principles of brakes and clutches.	
CO4	Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue.	
CO5	Apply engineering design tools to product design.	
CO6	Become good design engineers through learning the art of working in a team.	

Course code:18ME63		Course:HEAT TRANSFER
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand the modes of heat transfer and apply the basic laws to formulate engineering systems.	
CO2	Understand and apply the basic laws of heat transfer to extended surface, composite material and unsteady state heat transfer problems.	
CO3	Analyze heat conduction through numerical methods and apply the fundamental principle to solve radiation heat transfer problems.	
CO4	Analyze heat transfer due to free and forced convective heat transfer.	
CO5	Understand the design and performance analysis of heat exchangers and their practical applications, Condensation and Boiling phenomena.	

Course code:18ME641		Course:NON-TRADITIONAL MACHINING
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand the compare traditional and non-traditional machining process and recognize the need for Non- traditional machining process.	
CO2	Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.	
CO3	Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.	
CO4	Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.	
CO5	Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.	

Course code:18ME642		Course: REFRIGERATION AND AIR CONDITIONING
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	

CO1	Illustrate the principles, nomenclature and applications of refrigeration systems.
CO2	Explain vapour compression refrigeration system and identify methods for performance improvement
	Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermoacoustic refrigeration systems.
CO3	
CO4	Estimate the performance of air-conditioning systems using the principles of psychrometry.
CO5	Compute and Interpret cooling and heating loads in an air-conditioning system.
CO6	Identify suitable refrigerant for various refrigerating systems.

Course code:18ME643		Course:THEORY OF ELASTICITY
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand the Basic field equations of linear elastic solids, force, stress, strain and equilibrium in solids.	
CO2	Analyse the 2D structural elements, beams, cylinders.	
CO3	Use analytical techniques to predict deformation, internal force and failure of simple solids and structural components.	
CO4	Analyse the axisymmetric structural elements.	
CO5	Analyse the structural members subjected to torsion	
CO6	Determine the thermal stresses in plain stress and plane strain conditions.	

Course code:18ME644		Course:ADVANCED VIBRATIONS
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Characterize the single and multi-degrees of freedom systems subjected to free and forced vibrations with and without damping.	
CO2	Apply the method of vibration measurements and its controlling.	
CO3	Determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation.	
CO4	Analyze the mathematical model of a linear vibratory system to determine its response.	
CO5	Obtain linear mathematical models of real life engineering systems.	
CO6	Apply the principles of vibration and noise reduction techniques to real life engineering problems.	

Course code:18ME645		Course:COMPOSITE MATERIALS TECHNOLOGY
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Use different types of manufacturing processes in the preparation of composite materials	
CO2	Analyze the problems on macro mechanical Behavior of composites	
CO3	Determine stresses and strains relation in composites materials.	
CO4	Understand and effective use of properties in design of composite structures	
CO5	Perform literature search on a selected advanced material topic.	

Course code:18ME651		Course:NON CONVENTIONAL ENERGY SOURCES
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.	
CO2	Know the need of renewable energy resources, historical and latest developments.	
CO3	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying, cooking etc.	
CO4	Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.	
CO5	Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications	

Course code:18ME652		Course:WORLD CLASS MANUFACTURING
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand recent trends in manufacturing.	
CO2	Demonstrate the relevance and basics of World Class Manufacturing.	
CO3	Understand customization of product for manufacturing.	
CO4	Understand the implementation of new technologies.	
CO5	Compare the existing industries with WCM industries.	

Course code:18ME653		Course:SUPPLY CHAIN MANAGEMENT
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand the framework and scope of supply chain management.	
CO2	Build and manage a competitive supply chain using strategies, models, techniques and information technology.	
CO3	Plan the demand, inventory and supply and optimize supply chain network.	
CO4	Understand the emerging trends and impact of IT on Supply chain.	

Course code:18ME654		Course:ADVANCED MATERIALS TECHNOLOGY
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Explain the concepts and principles of advanced materials and manufacturing processes.	
CO2	Understand the applications of all kinds of Industrial materials.	
CO3	Apply the material selection concepts to select a material for a given application.	
CO4	Define Nanotechnology, Describe nano material characterization.	
	Understand the behaviour and applications of smart materials, ceramics, glasses and non-metallic materials.	
CO5		

Course code:18MEL66		Course:COMPUTER AIDED MODELLING AND ANALYSIS LAB
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Use the modern tools to formulate the problem, create geometry, discretize, apply boundary conditions to solve problems of bars, truss, beams, and plate to find stresses with different-loading conditions.	
CO2	Demonstrate the ability to obtain deflection of beams subjected to point, uniformly distributed and varying loads and use the available results to draw shear force and bending moment diagrams.	
CO3	Analyze and solve 1D and 2D heat transfer conduction and convection problems with different boundary conditions.	
	Carry out dynamic analysis and finding natural frequencies of beams, plates, and bars for various boundary conditions and also carry out dynamic analysis with forcing functions.	
CO4		

Course code:18MEL67		Course:HEAT TRANSFER LAB
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Determine the thermal conductivity of a metal rod and overall heat transfer coefficient of composite slabs.	
CO2	Determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.	
CO3	Evaluate temperature distribution characteristics of steady and transient heat conduction through solid cylinder experimentally.	
CO4	Determine surface emissivity of a test plate and Stefan Boltzmann constant	
CO5	Estimate performance of a refrigerator and effectiveness of a fin and Double pipe heat exchanger	

Year: IV		SEM VII
Course code:18ME71		Course:CONTROL ENGINEERING
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Identify the type of control and control actions.	
CO2	Develop the mathematical model of the physical systems.	
CO3	Estimate the response and error in response of first and second order systems subjected standard input signals.	
CO4	Represent the complex physical system using block diagram and signal flow graph and obtain transfer function.	
CO5	Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain.	

Course code:18ME72		Course: COMPUTER AIDED DESIGN AND MANUFACTURING
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen	
CO2	Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.	
CO3	Analyse the automated flow line to reduce time and enhance productivity.	
CO4	Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.	
CO5	Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.	

Course code:18ME731		Course:DESIGN FOR MANUFACTURE
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Select proper materials and manufacturing processes for designing products/components by applying the relevant principles for ease and economic production.	
CO2	Identify faulty design factors leading to increased costs in producing mechanical components.	
CO3	Apply appropriate design tolerances – dimensional, geometric and true position tolerances for the production processes of mechanical components.	
CO4	Apply the concepts related to reducing machined areas, simplification by amalgamation and separation, clampability, accessibility etc., in the design of mechanical components.	
CO5	Analyse the design of castings, weldments, forgings, powder metallurgy components and suggest design modifications to reduce the cost.	

Course code:18ME732		Course: AUTOMATION & ROBOTICS
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Translate and simulate a real time activity using modern tools and discuss the Benefits of automation.	
CO2	Identify suitable automation hardware for the given application.	
CO3	Recommend appropriate modelling and simulation tool for the given manufacturing Application.	
CO4	Explain the basic principles of Robotic technology, configurations, control and Programming of Robots.	
CO5	Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications	

Course code:18ME733		Course:COMPUTATIONAL FLUID DYNAMICS
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Understand mathematical characteristics of partial differential equations.	
CO2	Explain how to classify and computationally solve Euler and Navier-Stokes equations.	
CO3	Make use of the concepts like accuracy, stability, consistency of numerical methods for the governing equations.	
CO4	Identify and implement numerical techniques for space and time integration of partial differential equations.	
CO5	Conduct numerical experiments and carry out data analysis.	
CO6	Acquire basic skills on programming of numerical methods used to solve the Governing equations.	

Course code:18ME734		Course: TOTAL QUALITY MANAGEMENT
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Explain the various approaches of TQM	
CO2	Infer the customer perception of quality	
CO3	Analyse customer needs and perceptions to design feedback systems.	
CO4	Apply statistical tools for continuous improvement of systems	
CO5	Apply the tools and technique for effective implementation of TQM.	

Course code:18ME735		Course:OPERATIONS RESEARCH
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Understand the meaning, definitions, scope, need, phases and techniques of operations research.	
CO2	Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.	
CO3	Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.	
CO4	Solve problems on game theory for pure and mixed strategy under competitive environment.	
CO5	Solve waiting line problems for M/M/1 and M/M/K queuing models.	

Course code:18ME741		Course:ADDITIVE MANUFACTURING
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.	
CO2	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.	

CO3	Understand the various software tools, processes and techniques that enable advanced/additive manufacturing.
CO4	Apply the concepts of additive manufacturing to design and create components that satisfy product development/prototyping requirements, using advanced/additive manufacturing devices and processes
CO5	Understand characterization techniques in additive manufacturing.

Course code:18ME742		Course:EMERGING SUSTAINABLE BUILDING COOLING TECHNOLOGIES
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Empathize with sustainable cooling as a means of enhancing social justice in India and mitigating climate change through their intellectual capabilities and ethical orientation	
CO2	Compute and Interpret cooling and heating loads in a building and how they could be efficiently managed by using building energy modelling software	
CO3	Estimate the performance of airconditioning systems using the principles of thermodynamics, heat transfer, and psychometry	
CO4	Calculate and interpret the energy, cost, and greenhouse gas emissions performance of conventional and sustainable cooling technologies.	
CO5	Conduct building and sustainable cooling modelling projects on a sophisticated building energy modelling software.	

Course code:18ME743		Course:THEORYOF PLASTICITY
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand stress, strain, deformations, relation between stress and strain and plastic deformation in solids	
CO2	Understand plastic stress-strain relations and associated flow rules.	
CO3	Perform stress analysis in beams and bars including Material nonlinearity.	
CO4	Analyze the yielding of a material according to different yield theory for a given state of stress.	
CO5	Interpret the importance of plastic deformation of metals in engineering problems.	

Course code:18ME744		Course:MECHATRONICS
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Illustrate various components of Mechatronics systems.	
CO2	Assess various control systems used in automation.	
CO3	Design and conduct experiments to evaluate the performance of a mechatronics system or component with respect to specifications, as well as to analyse and interpret data.	
CO4	Apply the principles of Mechatronics design to product design.	
CO5	Function effectively as members of multidisciplinary teams.	

Course code:18ME745		Course: PROJECT MANAGEMENT
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand the selection, prioritization and initiation of individual projects and strategic role of project management.	
CO2	Understand the work breakdown structure by integrating it with organization.	
CO3	Understand the scheduling and uncertainty in projects.	
CO4	Understand risk management planning using project quality tools.	
CO5	Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects.	

Course code:18MEL77		Course: DESIGN LAB
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts.	
CO2	Carry out balancing of rotating masses.	
CO3	Analyse the governor characteristics.	
CO4	Determine stresses in disk, beams, plates and hook using photo elastic bench.	
CO5	Determination of Pressure distribution in Journal bearing	
CO6	Analyse the stress and strains using strain gauges in compression and bending test and stress distribution in curved beams.	

YEAR IV

Course code:18ME81		SEM VIII Course: ENERGY ENGINEERING
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand the construction and working of steam generators and their accessories.	
CO2	Identify renewable energy sources and their utilization.	
CO3	Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, nuclear, hydel and tidal.	

Course code:18ME824		Course:AUTOMOTIVE ENGINEERING
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Identify the different parts of an automobile and it's working.	
CO2	Understand the working of transmission and braking systems.	
CO3	Understand the working of steering and suspension systems and their applications.	
CO4	Selection and applications of various types of fuels and injection systems. Analyse the cause of automobile emissions, its effects on environment and methods to reduce the emissions.	

Course code:18ME821		Course: CNC MACHINE TOOLS
CO No.	COURSE OUTCOMES (Cos)	
	At the end the course student will able to	
CO1	Understand evolution, classification and principles of CNC machine tools.	
CO2	Learn constructional details of CNC machine tools, selection of standard components used for CNC machine tools for accuracy and productivity enhancement.	
CO3	Select drives and positional transducers for CNC machine tools.	
CO4	Apply CNC programing concepts of for two axis turning centers and three axis vertical milling centers to generate programs different components.	
CO5	Generate CNC programs for popular CNC controllers.	
CO6	Analyse and select tooling and work holding devices for different components to be machined on CNC machine tools.	

Course code:18ME822		Course: TRIBOLOGY
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Understand the fundamentals of tribology and associated parameters.	
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.	
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.	
CO4	Select proper bearing materials and lubricants for a given tribological application.	
CO5	Apply the principles of surface engineering for different applications of tribology.	

Course code:18ME823		Course: NON-DESTRUCTIVE TESTINGAND EVALUATION
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Classify various on-destructive testing methods.	
CO2	Check different metals and alloys by visual inspection method.	
CO3	Explain and perform non-destructive tests like: Liquid penetrant test, Magnetic particle test, Ultrasonic test, X- ray and Gamma ray radiography, Leak Test, Eddy current test.	
CO4	Identify defects using relevant NDT methods.	
CO5	Differentiate various defect types and select the appropriate NDT methods for better evaluation.	
CO6	Document the testing and evaluation of the results.	

Course code:18ME825		Course:TOOL DESIGN
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Select appropriate cutting tools required for producing a component.	
CO2	Understand and interpret cutting tool and tool holder designation systems.	
CO3	Select suitable locating and clamping devices for a given component for various operations.	
CO4	Analyze and design a jig/fixture for a given simple component.	
CO5	Understand various press tools and press tool operations.	
CO6	Classify and explain various die casting and injection moulding dies.	

Course code:18ME826		Course: FRACTURE MECHANICS
CO No.	COURSE OUTCOMES (Cos)	
At the end the course student will able to		
CO1	Analyse the effects of crack like defects on the performance of Aerospace, Civil, and Mechanical Engineering structures.	
CO2	Apply the concepts of fracture mechanics to select appropriate materials for engineering structures to insure damage tolerance.	
CO3	Understand mechanics of crack tip fields and appropriate fracture characterizing parameters like stress intensity factor and J integral or nonlinear energy release rate and how to compute them using various methods.	
CO4	Apply the concepts of fracture mechanics to determine critical crack sizes and fatigue crack propagation rates in engineering structures leading to life estimation.	
CO5	Understand the status of academic research in field of fracture mechanics.	